

## STEP 4: REFERENCE CONDITIONS

Reference conditions are ideally used to explain how ecological conditions have changed as the result of human influence and natural disturbances to enable comparison with current conditions. Because accurate and comparable documentation of ecological changes through time are not available for most resources within the District in a form that would be usable to establish reference conditions, this section relies on goals gleaned from the Forest Plan, established state resource standards, and Forest Service guidance that were developed with the conditions and values of the ecosystems of the Carson National Forest in mind.

Goals identified in the Carson National Forest Plan that are relevant to this assessment include achieving satisfactory watershed conditions that would result in improving the productivity of the land and working towards a more environmentally acceptable road system. These reference conditions are then used for comparison with current conditions to assess the functioning of ecological processes, without determining the optimal conditions (USFS 1995). They can also be used to explain how resource conditions have changed if the historical context and trends are available.

Due to the importance of District land use through time, an overview of the prehistory and history of the District is presented first to enable the current and reference conditions of the core topics to be considered in context.

### Historic Overview

The District and associated watersheds has an extensive history of prehistoric use. Archaeological excavations indicate that the watersheds were being used by Native Americans for thousands of years prior to European settlement. Evidence of prehistoric dwelling and campsites from these tribes is present throughout the San Juan Basin. In general, Native American use follows the general pattern of development from hunting and gathering, to the foundation of agriculture, to the establishment of communities, trade, and transportation corridors.

Anglo settlement, the impetus of which can be traced to the passage of the 1862 Homestead Act, saw a rapid increase in population accompanied by expansion of both farming and ranching. Subsequent development brought about many changes to the physical, biological and human elements of the watershed attributable, in large part, to livestock grazing and the discovery and exploitation of hydrocarbon resources.

The cultural history of the District is largely linked to research conducted in the Navajo Reservoir region by Dittert (1958) and Eddy (1966, 1972), as well as more recent studies by Gerow and Hogan (2000), Wilshusen (1995), and Wilshusen et al. (2000) in adjacent regions to the south and west. Time-sequent phase designations and archaeological characteristics generally follow nominal descriptions from this northwestern part of New Mexico, although there also are some differences in the site characteristics typical of the District.

Alternative phase sequences for the region around the District are presented in **Table 18**. In general, the prehistory of the region is divided into five major periods. The earliest evidence of human occupations in the region is termed PaleoIndian. This is followed by the Archaic period during which the beginnings of agriculture emerge in the archaeological record. The earliest known occupations in the District are from the Archaic period. Only those periods and phases known to occur in the District, based on the archaeological record, are described briefly below.

**Table 18. Alternate Culture History Periodization Schemes in the Region Near the Jicarilla Ranger District**

Period	Age	Cultural Period/Phase by Source				
		Pecos	Dittert (1958)	Eddy (1972)	Vivian (1990)	Gerow and Hogan (2000)
A.D.	1900-present					
	1800			Lucero (Hispanic)		Cabazon
	1700		Gobernador	Gobernador (Navajo)		Gobernador
	1600		Dinétah			Dinétah
	1500					
	1400					
	1300	Pueblo IV				
	1200	Pueblo III	Montezuma	Largo-Gallina		Pueblo III
	1100					
	1000	Pueblo II		Arboles		Arboles
	900			Piedra		Rosa-Piedra
	800	Pueblo I	Rosa	Rosa	Rosa-Piedra	
	700					Sambrito
	600	Basketmaker III				
	500			Sambrito	Sambrito	
	400					
	300					Los Pinos
	200	Basketmaker II		Los Pinos	Los Pinos	
	100					
B.C.	0					
	-100					
	-200					
	-300					
	-400			Desert Culture		Oshara
	-500					
	-600					
	-700					
	-800					

### Archaic Period (ca. 5500 B.C. to A.D. 400)

Although hunting was important throughout the Archaic period, there was an increasing reliance on gathering of wild plant resources. Archaic hunting-and-gathering groups seem to have been small in size, probably consisting of no more than a few co-residential, extended families. Groups were highly mobile, continually moving to take advantage of geographic and seasonal variations in the availability of plant and animal resources.

There are only four recorded Archaic sites in the District, two in the Bancos watershed and two in the Carracas watershed, representing approximately ½ of 1 percent of all sites in the District.

### **Basketmaker II/Los Pinos Phase (A.D. 1-400)**

Los Pinos Phase sites typically consist of between one to four (or more) very shallow, saucer-shaped pit structures; sites with larger numbers of such structures are referred to as villages. Pit structures are often manifested by cobble rings or the remains of mud-mortared cobble stem walls that once supported horizontal cribbed log or pole structures (Eddy 1966, 1972; Ellis 1988; Gerow and Hogan 2000; Wilshusen et al. 2000). Sites containing varying numbers of such structures are generally situated on benches, terraces, or bluffs overlooking drainages (Eddy 1972; Gerow and Hogan 2000). They suggest the emergence of village-level organization and perhaps, the first evidence of relatively sedentary occupations in the region (Eddy 1972), with evidence that seasonal camps were located in adjacent uplands. Despite the increased emphasis on agriculture, hunting and gathering of wild plant resources remained important throughout this period (Ellis 1988).

There are a total of 92 recorded sites containing Los Pinos Phase components in the District. Of these, 71 percent are situated in the Bancos watershed, 20 percent are in the La Jara watershed, 8 percent are in the Compañero watershed, and 2 percent are in the Carracas watershed. They are of particular interest to researchers not only due to their rarity, but also because of their importance in understanding early transitions to agriculture and the adoption of sedentary settlement patterns. The first signs of population aggregation in the region are marked by the BM II period, with continuing population growth trends for the next 600 years.

### **Basketmaker III (ca. A.D. 500 to 700); Basketmaker III/Sambrito Phase (A.D. 400-700)**

Unlike the shallow pit structures found at Los Pinos Phase sites, classic semi-subterranean pithouses are first encountered during the Sambrito Phase (Eddy 1972). Aboveground, mud-plastered structures ("jacals"), while present, are far less common during the Sambrito phase (Eddy 1972).

Sites ranging from single pithouses to multiple pithouses are, as in earlier times, situated along benches overlooking drainages. This suggests continued semi-sedentary village organization similar to that inferred for the Los Pinos Phase and a continuing emphasis on agriculture. Pit storage structures, first found during the Los Pinos Phase, increase in number and size, again consistent with reliance on stored agricultural surpluses (Eddy 1972).

Relative to earlier periods, BM III sites are far more visible due to longer occupations. The shift to domesticated crops is reflected by changes in settlement patterns during BM III times. Compared to earlier times, BM III sites are disproportionately oriented toward areas containing arable land. By late BM III times, reliance on agriculture appears to be general across the entire region.

There are a total of 94 recorded sites containing BM III/Sambrito Phase components in the District. Sites of this period constitute 11 percent of all known sites in the District. Of these, 69 percent are situated in the Bancos watershed, 19 percent are in the La Jara watershed, 10 percent are in the Compañero watershed, and 2 percent are in the Carracas watershed.

### **Pueblo I (ca. A.D. 700 to 900); Early Pueblo I/Rosa Phase (A.D. 700-850)**

Based primarily on Dittert's research from the late 1950s in the Navajo Reservoir area, the Rosa Phase is defined on the basis of the co-occurrence of pithouses and above-ground pole structures plastered with adobe (Dittert 1958). There is, as well, an increase in the overall quantity of artifacts at sites from this period and, for the first time, the presence of many features (e.g., storage pits, hearths) situated outside residential structures (Eddy 1972; Ellis 1988; Marshall 1997). Above-ground jacals, seemingly absent during Sambrito times, reappear as common structures during the Rosa Phase (Eddy 1972), although most were rectangular in plan and constructed of upright poles rather than the cribbed structures found at earlier Los Pinos Phase sites (Wilshusen et al. 2000).

Rosa Phase sites typically consist of varying numbers of pithouses (Eddy 1972). Sites containing two to five structures are termed “multiple-unit” sites, while those exhibiting more than six pithouses are termed “villages” (Dittert 1958; Eddy 1972). Stockaded settlements dating to this phase are also known from the Gobernador region (Hall cited in Wilshusen et al. 2000). Sites of this period tend to occur on mesa tops, benches overlooking drainages, or drainage confluences (Dittert 1958; Wilshusen et al. 2000).

Sites containing varying numbers of pithouses are generally situated on benches overlooking drainages (Eddy 1972; Gerow and Hogan 2000). Village-level organization seems to persist during this period, although activity-specific (e.g., hunting and gathering) seasonal camps continue to be found in a variety of settings (Eddy 1972).

There are a total of 234 recorded sites containing Rosa Phase components in the District. Components dating to this period are present at 27 percent of all known sites in the District. Of these, 40 percent are situated in the Bancos watershed, 32 percent are in the La Jara watershed, 18 percent are in the Compañero watershed, and 10 percent are in the Carracas watershed.

### **Late Pueblo I/Piedra Phase (A.D. 850-950)**

The Piedra Phase coincides with a period of notable climatic change over much of the Southwest. Specifically, this interval coincides with a period of increased variability in summer monsoonal precipitation compounded, in part, by declining winter precipitation (Wilshusen 1995; Wilshusen et al. 2000). The cumulative result is that agricultural pursuits in upland areas would have become more problematic, necessitating a settlement shift toward more stable surface water sources in riverine settings (Wilshusen 1995) (Wilshusen et al. 2000).

Similar to earlier phases, Piedra Phase sites typically contain a mix of pithouses, jacals, and associated exterior features such as hearths (Eddy 1966, 1972; Ellis 1988; Gerow and Hogan 2000). However, sites of this period tend to exhibit larger numbers of structures, indicating that populations continued to become more concentrated into fewer, larger settlements (Eddy 1972; Gerow and Hogan 2000). The causes underlying population concentration remain controversial, although the presence of some stockaded villages, burned pithouses, and cannibalized human skeletons suggests that competition for resources and potential warfare may have emerged during the Piedra Phase (Eddy 1972).

Resource competition as a factor contributing to changes during this period rests largely on data indicating that agricultural production may have reached a peak during this period (Eddy 1972). Storage facilities, notably above- and below-ground storage, do not appear to have changed substantially, nor is there evidence of noticeable increases in population (Eddy 1972; Gerow and Hogan 2000). Rather, loss of agricultural lands due to erosion and headcutting is thought to have contributed to resource stress throughout much of this region (Wilshusen et al. 2000).

There are a total of 126 recorded sites containing Piedra Phase components in the District. Sites with components dating to this period are present at 15 percent of all known sites in the District. Of these, 38 percent are situated in the Bancos watershed, 29 percent are in the Compañero watershed, 19 percent are in the La Jara watershed, and 14 percent are in the Carracas watershed.

### **Pueblo II/Arboles Phase (A.D. 950-1050)**

The Arboles Phase represents the last prehistoric occupation of the project area before what appears to be a long occupational hiatus (Dittert 1958; Eddy 1972). The Arboles Phase is defined primarily by the appearance of Arboles Black-on-white associated with above-ground masonry architecture; however, pithouses continued as the main type of residential structure during this period (Eddy 1972; Gerow and Hogan 2000).

Arboles Phase sites are concentrated along waterways, suggesting that floodwater agriculture became crucial during this period (Eddy 1972; Gerow and Hogan 2000; Wilshusen 1995; Wilshusen et al. 2000). The presence of many varied storage structures implies that agricultural surpluses were produced and relied upon during the winter months.

There are a total of 94 recorded sites in the District that contain P II/Arboles Phase components. Sites of this period constitute about 11 percent of all known sites in the District. Of these, 41 percent are situated in the Bancos watershed, 37 percent are in the Compañero watershed, 18 percent are in the La Jara watershed, and 4 percent are in the Carracas watershed.

### **Pueblo III/Pueblo IV/Largo-Gallina Phase (A.D. 1050-1300)**

Largo-Gallina Phase occupations remain poorly understood, despite almost a century of research. Sites of this period contain pithouses, stone residential structures termed “unit houses,” ramadas, and storage facilities (Mackey and Green 1979). In addition, stone towers interpreted as defensive structures are also known (Ellis 1988; Mackey and Green 1979).

Subsistence activities during this period seem to have focused primarily on dryland farming employing terraces or grid borders (Mackey and Green 1979), in conjunction with reliance on available wild plant and animal resources. The causes for the apparent abandonment of agricultural villages during this period may lie in climate change (Dean 1996). Largo-Gallina Phase occupations coincide with this period of climatic deterioration (Mackey and Green 1979).

There are a total of five recorded sites in the District that contain Largo-Gallina Phase components. Sites of this period constitute about 0.6 percent of all known sites in the District, indicating that Largo-Gallina Phase occupations of the District appear to have been minimal. Large habitation sites appear to be rare and the District may have been used for seasonal hunting and gathering activities during this period (Gerow and Hogan 2000). Approximately 40 percent of the recorded sites are situated in the Carracas watershed, 40 percent in the La Jara watershed, and 20 percent in the Bancos watershed. There are no sites of this period in the Compañero watershed.

### **Historic Period (ca. A.D. 1540 to Present)**

Before considering historic Navajo occupations of the District, it should be mentioned that small numbers of Jicarilla Apache components, most related to the Reservation (1877) and later periods, are found in its northern reaches. While no Southern Ute components have been recorded in the District, it is likely that they would date to pre- and post-Reservation times, if they were found.

#### ***Navajo: Dinétah-Gobernador (A.D. 1540-ca. 1770)***

The earlier portion of the historic Navajo period is termed “Dinétah.” Dinétah is typified by what appear to be seasonally occupied sites alternating between forked-pole hogans excavated slightly into the ground or ramada-like surface structures (Gerow and Hogan 2000). This alternating pattern of settlement is consistent with either: (a) semi-permanent occupations at hogans with seasonal reliance on ramadas in adjacent areas; or (b) a bi-seasonal settlement pattern alternating between hogans (winter) and ramadas (summer). Although cultivated plant remains have been recovered from some Dinétah Phase sites (Eddy 1972), suggesting a reliance on agriculture, the majority of remains are more consistent with hunting-and-gathering activities (Gerow and Hogan 2000; Wilshusen 1995).

There are a total of 82 sites in the District, whose characteristics are consistent with Dinétah Phase occupations. Components dating to this period are present at 9.5 percent of all known sites in the District. Of these, 52 percent are situated in the Compañero watershed, 37 percent are in the La Jara watershed, 10 percent are in the Bancos watershed, and 1 percent are in the Carracas watershed (see Water Resources section).

Gobernador Phase sites are usually dated to ca. 1696 (Gerow and Hogan 2000; Wilshusen et al. 2000). This coincides with the reconquest of New Mexico by Vargas and the attendant abandonment of many Rio Grande pueblos. It was once thought that former residents of these pueblos then took refuge with the Navajo, remaining there for many years and, in some instances, inter-marrying into Navajo groups (Gerow and Hogan 2000; Marshall and Hogan 1991). While the overall extent of this exodus is not clear, it nonetheless does not seem to have been substantial (Gerow and Hogan 2000; Marshall and Hogan 1991).

Settlement data, as well as archaeobotanical remains, suggest that the Gobernador Phase was typified by agricultural pursuits (Wilshusen 1995). Sites seem to be concentrated near stream confluences, suggesting

agriculture was an important subsistence activity (Eddy 1972; Gerow and Hogan 2000). This inference is supported by the recovery of botanical remains indicating that corn, squash, and beans were cultivated (Marshall and Hogan 1991). Storage of agricultural products took place in sub-floor pits within hogans, in outside storage pits, and in rockshelters (Eddy 1972; Marshall and Hogan 1991). The presence of corrals and sheep pens, in conjunction with the recovery of sheep, goat, and horse bones, indicates that herding was an important aspect of subsistence activities at Gobernador Phase sites (Marshall and Hogan 1991).

Gobernador Phase sites contrast strongly with Dinéah Phase sites, consisting of forked-stick, cribbed log, or stone masonry hogans (Eddy 1972; Gerow and Hogan 2000; Marshall and Hogan 1991, Wilshusen et al. 2000). As well, pueblitos, fortified sites, ramadas, and sweat-lodges are also common. Pueblitos have recently been interpreted as defensive sites used by Navajo in response to Ute incursions (Eddy 1972; Gerow and Hogan 2000; Marshall and Hogan 1991; Wilshusen et al. 2000). Three pueblito sites in the District were listed on the NRHP on January 21, 1987, as part of a thematic nomination of Gobernador Phase Navajo Refugee sites in the Dinéah area. The National Register sites are Pueblito Canyon Ruin, Cabresto Mesa Tower Complex, and Pueblito East Ruin, all of which are located in the La Jara watershed.

There are a total of 68 recorded sites in the District whose characteristics are consistent with Gobernador Phase occupations. Components dating to this period are present at 7.9 percent of all known sites in the District. Of these, 47 percent are situated in the Compañero watershed, 29 percent in the La Jara watershed, and 24 percent in the Bancos watershed. There are no sites of this period in the Carracas watershed.

#### ***Historic Southern Utes (A.D. 1600-present)***

Despite the lack of recorded archaeological evidence of Southern Ute occupations in the District, ethnographic and documentary sources indicate that this region encompasses lands formerly used by this group.

The Southern Ute are variously argued to have arrived in northern New Mexico as early as A.D. 1300 (Schroeder 1965), but certainly no later than the 1600s (Gerow and Hogan 2000). Loosely organized into as many as seven bands, the Capote band is tentatively identified as having resided in the general area of the District until the mid-19<sup>th</sup> century (Gerow and Hogan 2000; Jefferson et al. 1972; Schroeder 1965; Torrez 1989).

Prior to Spanish contact, Ute subsistence relied primarily on wild plant and animal resources, although some domesticates (e.g., corn) were also cultivated (Jefferson et al. 1972). Reliance on resources distributed seasonally in different geographic zones was accompanied by a relatively high degree of mobility. Mountains were favored for hunting-and-gathering during the summer and fall (Torrez 1989). Spanish and Pueblo goods were obtained from periodic markets at Abiquiu to the east, usually in exchange for wild resources (Torrez 1989).

Seasonal movement patterns typifying Ute groups throughout much of the 17<sup>th</sup>, 18<sup>th</sup>, and 19<sup>th</sup> centuries left little archaeological evidence of their presence. Ethnographic descriptions indicate that Ute camps consisted of tipis, cooking features, and minimal long-term storage facilities (Jefferson et al. 1972). As a consequence, Ute archaeological sites are difficult to identify since they exhibit minimal amounts of discarded artifacts and features, if present, can be ephemeral.

#### ***Historic Jicarilla Apache (A.D. 1600-present)***

The District is west of the nominal traditional territory of the Jicarilla Apache (Anonymous 1974; Tiller 1979). Accordingly, there is minimal archaeological evidence of Jicarilla Apache occupations in the District.

The Jicarilla Apache were one of a number of Southern Athabaskan-speaking groups who migrated into Colorado and northern New Mexico between A.D. 1300-1600, largely in response to pressures from other American Indian groups. By ca. A.D. 1700, the arrival of Comanches accelerated the migration process that had been underway for some time (Anonymous 1974; Thomas 1974; Tiller 1979).

Prior to Spanish contact, Jicarilla Apache subsistence relied primarily on wild plant and animal resources, although there is evidence that domesticates (e.g., corn) were also cultivated (Thomas 1974; Tiller 1979). Reliance on resources distributed seasonally in different geographic zones was accompanied by a relatively high degree of mobility. As horses were acquired from Spanish settlers, Spanish and Pueblo goods were

frequently obtained from raiding expeditions—often in alliance with the Navajo—against Spanish and Pueblo settlements along the Rio Grande (Thomas 1974). The Jicarilla were major trade partners with the Spanish as well prior to 1720.

Seasonal movement patterns typified Jicarilla Apaches throughout the 17<sup>th</sup>, 18<sup>th</sup>, and 19<sup>th</sup> centuries. Ethnographic descriptions indicate that Jicarilla Apache settlements alternated between semi-sedentary villages (“rancherías”)—described in contemporary accounts as consisting of flat-roofed adobe structures—and seasonal hunting-and-gathering camps (Thomas 1974; Tiller 1979). As a consequence, protohistoric and historic Jicarilla Apache archaeological sites are difficult to identify since they exhibit minimal amounts of discarded artifacts and features, if present, can be ephemeral.

By the mid-19<sup>th</sup> century, acquisition of the territory by the United States, combined with decades of progressive incursions on their territory, caused the Jicarilla Apache to largely abandon their former subsistence practices. During this period, Jicarilla Apache reemphasized hunting, gradually reducing their emphasis on agriculture (Anonymous 1974; Tiller 1979). Despite these difficulties, large villages were still found (Anonymous 1974).

There are only three recorded sites in the District whose characteristics are consistent with historic Apache occupations. This represents less than ½ of 1 percent of all known sites in the District. Two are situated in the Carracas watershed and one in the Bancos watershed. The actual spatial distribution of Apache sites remains uncertain given the small number that are known.

### ***Spanish Colonial Period (A.D. 1539-1821)***

The earliest evidence of Spanish entry (*entrada*) into New Mexico is associated with the appearance of Coronado's expedition in 1540 (Winship 1990). Initial contacts with the inhabitants were not promising and Coronado's men soon found that reports of gold were overstated and confrontational (Winship 1990). In 1542, after smaller expeditions into the surrounding country revealed no great wealth, Coronado's expedition withdrew to Mexico.

The Spanish did not return to the region until several decades had passed. In 1598, Oñate arrived with a large party of colonists, soldiers, and priests, to establish the village of San Gabriel, near the modern-day Pueblo of San Juan. In 1604, Oñate traversed portions of the District on his way to the Hopi Mesas and westward to California (Salmerón 1966). He returned by the same route, but did not establish any new Spanish settlements along the way. It is during Oñate's travels that we find the first written reference to the presence of Navajo Indians in what is today the Navajo heartland. They were referred to by Salmerón (1966) as “Apache Indians of Nabaju.”

There is almost no documentary evidence regarding the District area between Oñate's arrival in 1598 and the Pueblo Revolt of 1680. Seventeenth century Spanish settlements in the area were minimal and concentrated along the Rio Chama and Rio Grande valleys.

It is reasonable to assume that Spanish settlement brought new technologies and ways of life to indigenous peoples. Among the most important introductions were the use of metal, the introduction of domestic animals, new crops including wheat and barley, onions, garlic, chiles, and, to the detriment of the region's inhabitants, Old World diseases. By 1650, sheep and goat husbandry appear as progressively more important components of Native American subsistence. The Pueblo Revolt of 1680, as well as the 1694 rebellion that followed Vargas' 1692 reconquest of New Mexico, was accompanied by the relocation of the inhabitants of some Rio Grande pueblos.

Spanish activities during the 18<sup>th</sup> century focused primarily on consolidating their holdings in the Rio Grande valley. Settlements dating to this time period are unknown in the District.

### ***Mexican Period (A.D. 1821-1848)***

Mexico's declaration of independence from Spain in 1821 was accompanied by the opening of the Santa Fe Trail. This inaugurated a period of progressively greater interaction between Euro-Anglos from America and New Mexico's Native American and Hispanic residents.

Excluding events taking place in Navajo country, discussed earlier, this period is not particularly noteworthy with respect to Mexican activities in the District. There were no lands awarded during this period.

Like their Spanish Colonial predecessors, settlements were sparse during the Mexican Period. The closest Mexican Period land grant to the District was Tierra Amarilla (1832). There are only three Mexican period components in the District, all found in the Bancos watershed.

### ***Euro-Anglo Period (1848 to Present)***

In 1846, the arrival of Americans into New Mexico ushered in a new era in the region's history. With the subsequent defeat of the Mexican Army, and agreements reached under the Treaty of Guadalupe, New Mexico officially became a territory of the United States.

Conditions during the period between 1848 and the outbreak of the Civil War remained largely unchanged from those observed during the Mexican Period. Anglo or Hispanic settlements were very few in number.

The initial impetus for Anglo settlement in the region can be traced to passage in 1862 of the Homestead Act. Intended to promote settlement of the American West, the Act provided 160 acres to claimants once they "proved up" their claim by living and working on it. In the San Juan Basin, however, homesteading was inhibited by deteriorating conditions between settlers and Jicarilla Apaches, as well as constraints imposed by the instability of the Civil War.

Anglo settlements in the District did not emerge until the late 1870s. Unless otherwise noted, all the following establishment dates are from Julyan (1996). Among the earlier settlements in the region were Blanco (1870s), Gobernador (1875), and Rosa (1888), all near District land.

Perhaps the most pivotal event to affect the region as whole was the establishment of the Jicarilla Apache Reservation in 1880 (Wilson 1964). Due largely to pressure from ranching interests, this Reservation was closed between 1883 and 1887, at which time the federal government forced the Jicarilla Apaches to relocate to the Mescalero Apache Reservation in the southern part of the state. The forced relocation failed and, in 1887, the Reservation was reestablished at its former site.

Many initial economic activities typical of the mid- to late 19<sup>th</sup> century focused on farming and ranching. Farming varied from rainfall-based dryland farming in upland areas to irrigated agriculture in river valleys that had relatively perennial flows. Ranching focused almost exclusively on sheep, although some cattle were also raised. Sheep ranching expanded rapidly, with totals in the state increasing from 250,000 in 1830 to over 4,000,000 in 1880. Beginning in the 1850s and persisting through the 1860s, there were trail drives of large herds westward along a route that closely paralleled the Old Spanish Trail (Williams 1986).

In 1881, the "Farmington Branch" of the Denver and Rio Grande Western Railroad was constructed. Intended largely to transport commodities, particularly fruit, northward and manufactured goods into the San Juan Basin, a spur line extending from Durango, Colorado southward to Aztec and Farmington was completed in 1905 (Myrick 1990).

There are only 14 recorded sites containing artifacts consistent with Spanish-Mexican-Anglo occupations, representing 1.6 percent of all known sites in the District. Given the small numbers of such occupations, the significance of variations in the geographic distribution of historic Spanish-Mexican-Anglo sites is uncertain.

## **Jicarilla Ranger District History Affecting Rangeland Condition**

Intense grazing pressure and the resultant development of the deep arroyos has contributed to the current condition of rangeland within the District. While some of this is due to recent drought conditions and over-utilization by wild horses, livestock and wildlife, as stated in the Soils, Vegetation, and Wildlife sections, past grazing history has a great deal to do with the current state of erosion on the landscape and forage conditions. Following is a brief description of from early documents maintained in the District office.

Historical documents from the District provide quantitative and anecdotal descriptions of range conditions, which varied greatly from season to season. Conditions seem to be determined by the vagaries of the weather, which can cause the situation to change from severe to ideal within a month. The District historically has not only allowed grazing on designated allotments, but also has allowed livestock to cross through the District, which has led to very heavily used rangeland.



In October of that same year, permits were issued for 1,000 head of cattle and horses and 20,000 sheep to graze during that fall. A July 15, 1912, District report states that 61 crossing permits for the fiscal year (FY) were issued for the District for 100,199 sheep and goats.

A September 12, 1912, "District News" indicated that stockmen were satisfied to stay on their allotments, due to the plentiful summer rain that left reservoirs full and grass for the sheep in good condition. In November of that same year, 39,530 sheep are reported to have crossed the district to date, not including the approximately 1,000 led to the dipping vat. "District News" in December described conditions for sheep as difficult, with the forage in poor condition.

From August 1, 1912, to mid-January of 1913, 91,975 sheep and goats crossed the District. Mid-February shows the District as the only District to increase the numbers for cattle and horses, as well as sheep and goats. "District News" from September 1912 called the grazing season as the severest "since the creation of the Forest," with conditions in the District being the worst due to lack of water. Almost all the sheep on the north end of the District were reported to have left due to the dry conditions.

The "Carson Pine Cone" from November 22, 1921, reports the livestock allowances for 1922 as 1,200 cattle and 13,000 sheep and goats. A March 1923 report indicates the general trend in the District as changing from sheep and goats to cattle and horses. It is noted therein that in 1912, only 17 cattle and horses were allotted, compared to 12,842 sheep and goat. However, the 1923 authorization shows only 8,300 sheep and goats and 1,200 cattle and horses.

Erosion, particularly steep gullies, has always presented a management issue in the District. For example, an October 1923 report speculates that "four inches of rain fell during one continuous storm while the work was underway and the Jicarilla arroyos have probably been dug-out a couple of feet deeper as the result." In January of the next year, a report stated, "according to Grazing Reconnaissance, the District has two principal grazing types—rocks and arroyos." Robert Ground, who worked in the Forest as a ranger after returning from World War I, describes conditions in the District as "the hardest country to ride when I first went over there of any country I was ever in. Because these gullies, the walls of 'em were 10 or 15 feet high and you couldn't cross 'em just anywhere."

In April 2, 1959, Ruth G. Fish wrote of the District in "Dobe Dust: A County News Column" that "Erosion is severe, due to overgrazing in the early days, and the tendency of livestock to concentrate in the flat-bottomed canyons...the most pressing need in the District is erosion control. Spreader dams are needed to hold silt losses to a minimum and put water into the ground. Fences and stock tanks are necessary to improve cattle distribution and keep stock from overusing the canyon bottoms while the forage on the mesa is not utilized by livestock."

In a *Farmington Times* article of April 23, 1967, Rex Owen, the District Ranger, states in an article entitled, "Are We Losing Ground In Soil Conservation?" that "The presence of gullies is a sign of a complete failure in any soil conservation program. Gullies are like cancer once they get started they continue to grow." The article expressed concern over reduced range production and the invasion of plants that either are noxious or provide poor forage.

The movement of horses from the adjacent tribal land has presented certain issues historically as well. A July 7, 1928, "Carson Pine Cone" states that "the Jicarilla East Boundary fence is nearing completion. This will greatly reduce the drift of horses from the Indian Reservation." In March of the next year, the "Pine Cone" praises a roundup and sale of the horses by the Jicarilla Apache, saying that "this work will be a decided benefit to the District, as this stock trespassed in the Forest a part of the year." Robert Ground states of the neighboring tribe that "Sometimes their horses—they had a lot of horses at that time—and once in a while they'd get over on our side, but not very much."

Erosion, particularly steep gullies, has always presented a management issue in the District. In 1959, for example, Ruth G. Fish wrote of the Jicarilla in Dobe Dust: A County News Column that "Erosion is severe, due to overgrazing ... and the tendency of livestock to concentrate in the flat-bottomed canyons...the most pressing need in the District is erosion control." Furthermore, in a *Farmington Times* article of April 23, 1967, Rex Owen, the District Ranger, states in an article entitled, "Are We Losing Ground In Soil Conservation?" that "The presence of gullies is a sign of a complete failure in any soil conservation program. Gullies are like

cancer once they get started they continue to grow.” The article also expressed concern over reduced range production and the invasion of plants that either are noxious or provide poor forage.

### **Jicarilla Ranger District Mineral Development History**

The exploration for and production of natural gas are the primary minerals extraction activities in the District. Fluid minerals development in the District began in the 1950s and many of the original wells are still producing. The life of a well in the San Juan Basin can be more than 50 years.

The natural gas production rate from the entire San Juan Basin is approximately 4.0 billion cubic feet per day, approximately 4 percent of which (or approximately 160 million cubic feet [MMcf] per day) is extracted from the District. Rents and royalties received from natural gas production on the District was \$20,424,320 in FY 2001 with rents/bonuses totaling \$20,160.30 during the same year (MMS 2001). There were 131 producing leases covering 155,605 acres.

There are 676 active wells and 139 plugged and abandoned wells on 815 existing gas well pads with over 400 miles of associated access roads, pipelines, compressor stations, and other facilities located in the District. Anticipated future development in the District over the next 20 years has been estimated by the Reasonable Foreseeable Development Scenario (RFDS) (Engler et al. 2001) to be 694 new wells at a rate of approximately 35 wells per year.

Gas wells in the District produce primarily from the Pictured Cliffs, the Mesaverde Group, the Fruitland Coal, and the Dakota Formations. Future hydrocarbon extraction may include further development of these formations in addition to development of the Tertiary Sands of the Ojo Alamo, Nacimiento, and San Jose Formations. The RFDS projects that approximately 100 new wells may be drilled to the Tertiary Sands and the remainder to currently producing formations during the next 20 years (Engler et al. 2001).

Coalbed gas or coalbed methane (CBM) in the San Juan Basin is produced from the Cretaceous Fruitland formation. Production of CBM from the Fruitland coalbeds began in the late 1980s. As of 2000, more than 80 percent of the CBM production in the United States (U.S.) originated from the San Juan Basin. Fruitland wells are drilled on 320-acre spacing to an average depth of 2,600 feet. Fruitland coalbed wells are usually completed as open-hole cavities at depths that range from 750 to 3,600 feet and produce up to 6 MMcf of gas per day. Fracture stimulation with water may be required to enhance producibility. These wells produce from 50 to 500 thousand cubic feet of gas per day (Ayers 2002). A few horizontal wells have been drilled in the Fruitland Formation. Horizontal or other directional drilling has been used infrequently in the Basin, but its use may increase to facilitate the location of wells in order to minimize impacts on surface resources.

### **Erosion Processes**

The overall goal, or reference condition, for soils is to control erosion, minimize sedimentation, and maintain soil productivity to the point where all watersheds are in satisfactory soil condition. As shown in the articles and information from the District Forester cited above, soil erosion has been a concern in the District throughout the 20<sup>th</sup> century. Due to recent climatic conditions, surface disturbance and new roads from increasing gas well development, and an overpopulation of wild horses, it is likely that the indicators of soil condition have degraded beyond that characterized during field work for development of the TES, which is the basis for reference conditions.

It is desirable for current soil loss to be below the tolerance levels established for each soil map unit. The soil loss tolerance, a reference condition established in the TES, is the maximum rate of soil loss from sheet and rill erosion that can occur while sustaining inherent soil productivity. Concentrated surface water flows often result in gully erosion, a process that causes erosion at a much faster rate than sheet and rill erosion and the primary cause of the unsatisfactory condition ratings for portions of some watersheds. **Table 19** summarizes the soil loss tolerance, annual sheet and rill erosion rates, and the amount of each watershed in satisfactory condition.

**Table 19. Soil Loss Tolerance and Comparison with Current Conditions**

Watershed	Soil Loss Tolerance (tons per acre)			Average Annual Sheet/Rill Erosion (tons per acre)	Satisfactory Condition (%)
	Average	Minimum	Maximum		
Bancos	2.8	2.7	3.6	1.5	86%
Carracas	2.9	2.7	3.6	1.4	96%
Compañero	2.8	2.7	3.6	1.3	93%
La Jara	2.9	2.7	3.6	1.4	91%

Source: USFS 1993.

Due to the potential for high sediment yields from unpaved roads in arid climates, one goal for watershed management is to minimize sedimentation from roads by constructing and maintaining an environmentally acceptable road system. While not quantified in the Forest Plan in terms of minimum sediment yields, the Forest Service strives to have stable roads that do not exacerbate downstream water quality conditions through construction of roads with adequate drainage systems to reduce the length of road that transports surface water, and with a maximum grade of 8 percent except for short (not more than 300 feet) distances.

The Carson National Forest Plan (USFS 1990) has a stated goal, or reference condition, of achieving satisfactory conditions in all watersheds by the year 2030, to be accomplished by stabilization of soils on the landscape, obliteration of some roads, revegetation of areas with insufficient ground cover, and livestock grazing allotment management. Improving watershed condition would result in improving the productivity of the land.

## Water Quality

The Forest Plan lists a goal that water from National Forest lands will meet state water quality standards. No total maximum daily loads (TMDL) have been established for the San Juan River reaches that are the outlets for the watersheds draining from the District, but the New Mexico *303(d) List for Assessed Stream and River Reaches* (NMED 2000) provides an indication of the problems that can be used as a guide. The reference condition for assessing surface water resources, therefore, is to manage the land to minimize the likely sources of impairment listed in Table 5 so that the parameters of concern are reduced and the receiving waters from the District's watersheds are improved to the point that they are removed from this list in the future.

Groundwater quality concerns identified by the State of New Mexico (NMED 2001) in the San Juan Basin include leaking storage tanks mainly in the more populated areas near Farmington, Aztec, and Bloomfield and from oil and gas production, pipelines, storage, distribution and refining sites, as well point source groundwater contamination from natural deposits and from milling operations outside the District. In most places the quality of groundwater in the San Juan Basin generally ranges from fair to poor. The goal for protecting groundwater resources on National Forest lands is to minimize contamination from human uses of the land through the development and implementation of spill plans required by the NMED for industrial sites like gas wells, and to avoid any actions that would reduce groundwater quality, especially in recharge areas or injection wells used for disposal of produced water from gas wells.

## Vegetation

Vegetation management is important to maintain wildlife habitat, soil stability, groundwater recharge, and to protect water quality. Vegetation management involves protecting native vegetation because it is better than non-native species in providing the benefits to the watershed, but also to ensure that, when vegetation is disturbed, it is reestablished successfully. The Forest Plan includes vegetation management practices for all vegetation types within the District to ensure that vegetative diversity exists and that all vegetation types are productive. The goal is to keep vegetation removal and damage to a minimum. If vegetation must be

removed, native grass mixtures must be used to reestablish ground cover, with the understanding that these reclamation grasslands do not replace the benefits to wildlife that the natural cover provides. They afford some protection to the soil and downstream water quality if they are successfully established.

Noxious plants displace native plant communities and degrade wildlife habitat by competing with and often choking out native vegetation. Weed management is governed under the federal Noxious Weed Act, Public Law (PL) 93-629, 1974, and the Forest Service's March 1996 interagency document "Forest Service Weed Strategy." Weed management plans are required to be developed and implemented as part of any surface disturbing activity.

## **Species and Habitats**

There are no formal standards for measuring disruption or fragmentation of wildlife habitat, other than the Forest Plan requirement that the density of open roads within the deer and elk winter range areas not exceed 0.5 mi/mi<sup>2</sup> as a way to manage habitat effectiveness. The Forest Service (in the Forest Plan) has a general goal of maintaining wildlife habitat for all viable populations and improving the habitat for selected species (USFS 1990).

MIS species provide reference information regarding forest health and management activities within the Forest. Species trends are indicative of the condition of habitat(s) they occupy and the success of management activities within these habitats. Therefore, MIS can be used for evaluating the condition of the watersheds in the District, and as a guide in setting reference conditions for wildlife.

Guidance in the existing Wild Horse Management Plan for the District, approved in March 1977, recommends that the Wild Horse Territory maintain a herd population of not more than 50 horses. This was based on an assessment of overall range condition, trend, and forage production and utilization at that time. Management of the wild horse population affects the amount and health of available forage for other wildlife, especially elk, as well as the rangeland condition for livestock grazing and vegetative cover for minimizing soil erosion.

## **Human Uses**

The Historic Overview above provides the context for the human uses of the District. The area has been and continues to be used by several Indian tribes and remains important to them for traditional and cultural reasons. Due to overgrazing in the early 20<sup>th</sup> century, the land is still damaged from gullying and excessive surface water runoff that resulted from poor ground cover on erosive soils, a situation that can only be remedied over a long time and active human intervention through the installation and maintenance of soil and water conservation practices.

## **Minerals**

The vision in the Forest Plan states that "The Forest contributes to the nation's demand for minerals by encouraging responsible mineral development." (USFS 1990) The goal is to minimize impacts to surface resources while administering the mineral laws and regulations. When considering new leasing, the Forest Plan specifies limits to surface occupancy on slopes over 40 percent, in riparian areas, and within critical wildlife habitats.

All proposed wells on existing leases must consider the effects of siting wells and associated infrastructure (roads, borrow areas, pits, pipelines) on the natural and cultural environment through the development of an environmental assessment that meets National Environmental Policy Act (NEPA) requirements, as well as compliance with the National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA). Cultural and biological resources must be surveyed on the site and a clearance must be provided before approval for construction is given. Part of the approval process is the development and approval of a Surface Use Plan of Operations (SUPO), which outlines how the operator will use the land, including the well site layout, the locations of roads and pipelines, methods of handling waste disposal, and water sources. The Forest Service can add requirements to the SUPO to protect surface resources and Forest Service roads, and to ensure the mineral extraction activity complies with the Forest Plan. Reclamation plans are required for all

proposed surface-disturbing activities to return the land to productive uses consistent with the ecological capability of the area in accordance with land management goals.

## **Transportation**

Goals identified in the Carson National Forest Plan include working towards a more environmentally acceptable road system. Road management guidance listed in the Forest Plan states that roads will be inventoried and evaluated periodically for their intended use and maintenance levels. It provides a goal of obliterating some roads every year Forest-wide if they are not needed, either through abandonment that allows them to return to a natural condition or by seeding with grass. Restrictions on use should be employed to minimize user conflicts and protect surface resources. Roads may be closed seasonally to minimize erosion and sedimentation (such as during a spring thaw) or to protect critical wildlife habitat (such as during the use of the elk and deer winter range). Roads should meet construction and maintenance standards for drainage, surfacing, and gradient according to their designated maintenance levels in the road inventory.

## **Livestock Grazing**

Historical documents from the Carson NF provide quantitative and anecdotal descriptions of rangeland conditions, which varied greatly from season to season. Conditions are determined by the vagaries of the weather, which can cause the situation to change from severe to ideal in less than a month. The District has heavily used rangelands, when considering livestock grazing by cattle, elk, and wild horses on the same land, mainly in the northern watersheds of Carracas and Bancos. Overgrazing became a recognized problem as early as the 1950s and continues to be an issue in the District.

The Forest Plan goals for rangeland management include periodic evaluations to determine changes in management and to adjust permitted livestock numbers based on production utilization studies. It also requires providing forage without impairing land productivity and the maintenance of wild horse populations according to the management plan guidelines.

## **Recreation**

The Forest Plan provides for a balanced amount of developed and dispersed recreation experiences for the public. Recreational use of the District, however, has never been high, limited primarily to hunting in the fall. Recreation management is based on a system of categorizing the District according to a Recreation Opportunity Spectrum. Most of the District is identified as either Roaded Natural or Semi-primitive Motorized, due to the many roads that exist. Under both categories, Forest Plan standards and guidelines call for management of a natural appearing environment with moderate evidence of human intervention by requiring resource modifications that blend in with the surrounding landscape.

## **Cultural Resources**

The Forest Plan, along with other federal and state regulations, require protection and preservation of cultural resources on National Forest lands. Archaeological sites will be located and protected in advance of all surface disturbing activities. Any sites that have sustained damage or are vulnerable to damage from any cause will be stabilized, on a priority basis determined by Forest Service staff.

Protection of cultural resources includes not only stabilizing areas from soil erosion, but also limiting the alteration of the physical setting in which these resources are situated, reducing the potential for damage to structures from vibrations due to heavy equipment and drilling operations, and minimizing opportunities for vandalism. Nomination of priority sites to the NRHP and interpretation of cultural resources to educate the public on their importance are also listed as goals in the Forest Plan.

The Forest Service, according to federal policies, conducts ongoing consultation with tribes with interest in the District region to ensure that land management decisions take into account tribal concerns and respect traditional cultural properties.

## **Wild and Scenic Rivers Eligibility**

Consideration of eligibility for designation under the National Wild and Scenic Rivers Act (PL 90-542; USC§1271) was documented in the Forest Plan Amendment 12, which presents the decisions for eligibility of some areas designated in the District. The act was established by Congress in 1968 to preserve free-flowing rivers that possess certain “outstandingly remarkable” values. The “Wild” river areas represent vestiges of primitive America” (USDI 1982), and require management that prohibit new mining claims and mineral leases within ¼ mile of the water body and discourage most new structures and utilities infrastructure. “Recreational” river area is described by Section 2 (b) of the Act as “Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines and that may have undergone some impoundment or diversion in the past” (USDI 1982).

The areas within the District were designated due to their importance as valuable wildlife habitat, cultural resources, riparian areas, and relatively unroaded qualities. Because these designations crosscut several of the core topics above, a separate category has been included in this section to document the recommended management of the following areas. Implementation of these designations would support the overall goal of improving watershed conditions.

Bancos Canyon, in the Bancos watershed, was determined to be eligible as a “Wild” river due to its free-flowing condition, and its outstandingly remarkable recreational wildlife and cultural values. It is a popular hunting, hiking, and historic site viewing area, and a key winter migratory corridor and holding area for deer and wintering bald eagles. The entire canyon is being considered for nomination to the NRHP as an archaeological district due to its density of Anasazi and Navajo sites (USFS 1990).

La Jara Canyon, in the La Jara watershed, was determined to be eligible as a “Recreational” river due to its outstandingly remarkable wildlife, cultural, and riparian values (USFS 1990). It is a key winter and migratory corridor and security area for elk, deer, and wintering bald eagles, and is one of the few locations in the area capable of supporting riparian vegetation. La Jara Canyon also contains three Navajo defensive sites listed on the NRHP, as well several other sites associated with and important to the understanding of the National Register sites (USFS 1990).

Carracas Canyon, in the Carracas watershed, was determined to be eligible for its outstandingly remarkable wildlife, historic, and riparian values. Its importance for wildlife is due to the existence of a key winter migratory corridor and holding area for deer, significant security area for large bucks, and wintering bald eagles. Its historic value is due to Boiler Springs and a wagon road from Arboles to Dulce. The Old Spanish Trail may also pass through a portion of Carracas Canyon. It is one of a few places in the District that can support riparian plants (USFS 1990).

Vaqueros Canyon, in the La Jara watershed, was determined to be eligible for its outstandingly remarkable scenic value due to the diversity of colors in fall vegetation, wildlife values due to prime elk wintering habitat, historic value because it contains the historic Vaqueros Ranger Station site and is one of a few places in the District that can support riparian plants (USFS 1990).

Cabresto Canyon, in the Bancos watershed, was determined to be eligible for designation due to its outstandingly remarkable wildlife, historic, and cultural values. It contains key bald eagle habitat, an old school house, several homesteads, and an important petroglyph area (USFS 1990).